[BLANK PAGE]

API INTERNATIONAL

CCA

624.15
АРК 31525

RAYMOND COMPOSITE PILES

CONCRETE & WOOD

RAYMOND

Composite Piles

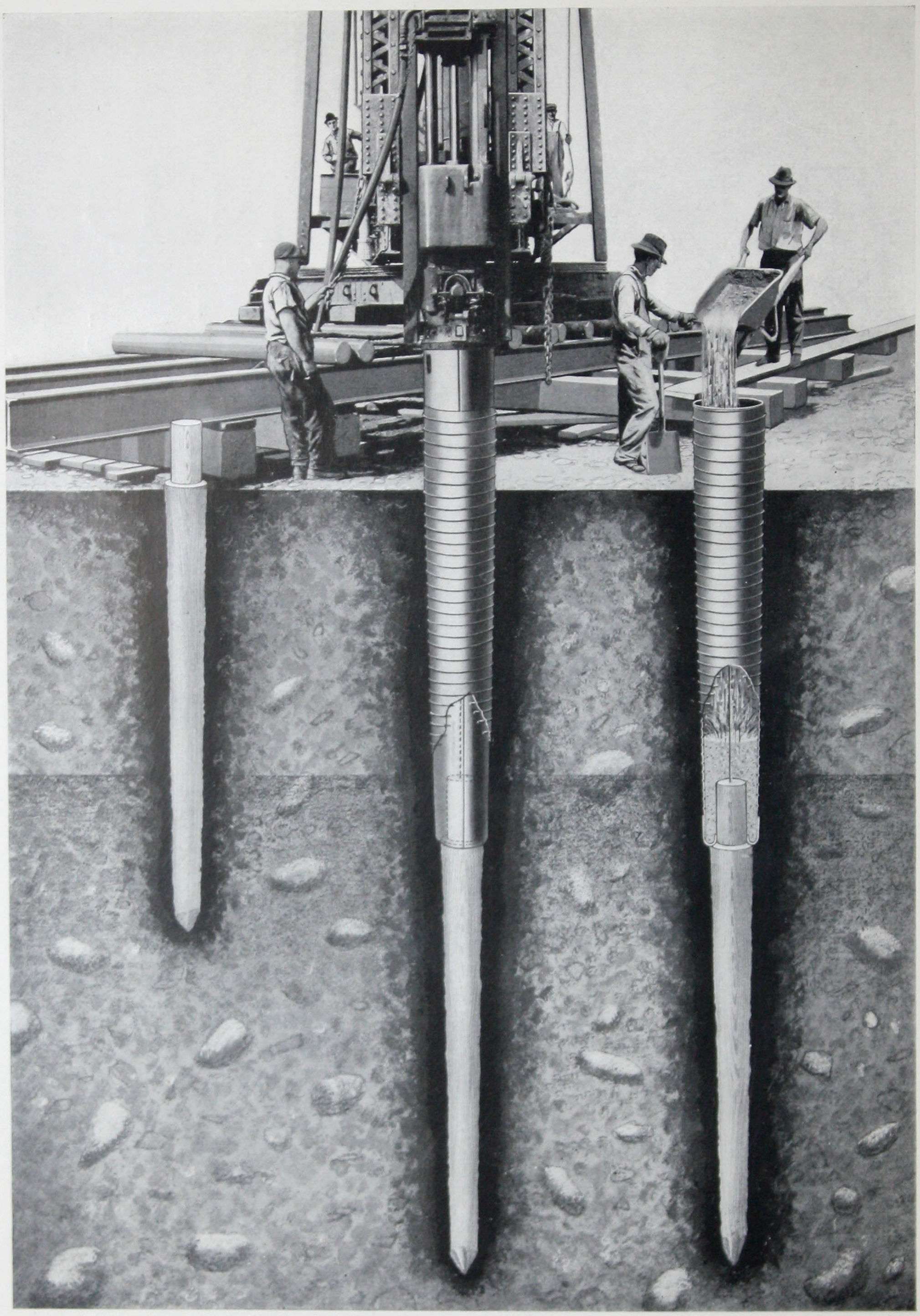
Concrete and Wood

A FORM
FOR EVERY
PILE

·

A PILE
FOR EVERY
PURPOSE

RAYMOND COMPOSITE PILES



The Raymond Composite Pile consists of a wood pile, cut off below permanent low water, upon which is superimposed a Raymond Concrete Pile

Raymond Composite Piles

(PATENTED)

Concrete and Wood

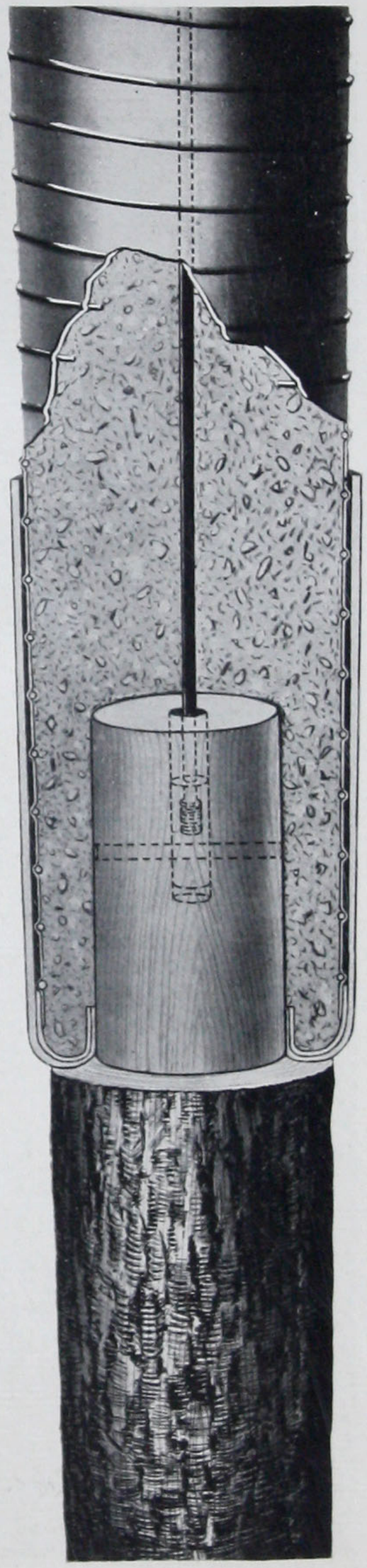
IT IS a well known fact that a wood pile shows its first evidence of deterioration at the top. This naturally suggests the permanency of a wood pile unit having a concrete top extending down to an elevation well below permanent water level. Which is accomplished by the RAYMOND COMPOSITE PILE.

Its development is an outgrowth of the wide experience which the RAYMOND CONCRETE PILE COMPANY has acquired in the placing of millions of feet of concrete piling under an infinite variety of soil and water conditions.

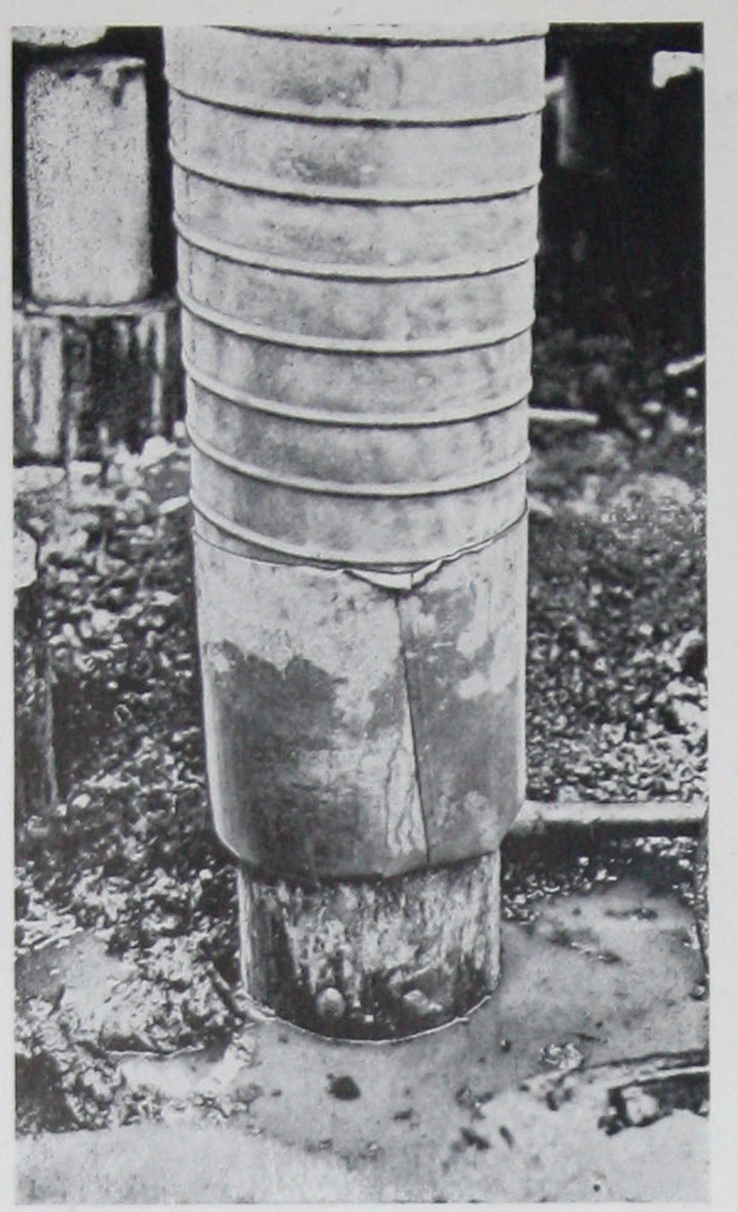
Where long piles are required and permanent water level is within a reasonable distance below the surface, it is usually cheaper to substitute wood for concrete in that portion of the pile which is permanently submerged. The idea is not a new one but the development of *a joint of sufficient strength and rigidity*, together with a method that will insure uniform and satisfactory results, has required considerable thought and ingenuity and a long series of experiments.

After several years of experimentation and development we have produced a joint between the wood and concrete sections which is practically as strong as any part of the completed pile. The RAYMOND COMPOSITE PILE can be considered a recognized structural unit.

Wood piles, in order to be permanent, must be cut off below water level. If they are permanently submerged, they will last for centuries, providing they are not attacked by animal life or chemical action. *The* RAYMOND COMPOSITE PILE *consists of a wood pile, cut off below permanent low water, upon which is superimposed a* RAYMOND CONCRETE PILE. Following this method more than three million feet of RAYMOND COMPOSITE PILES have been driven and they have been found to meet the most exacting requirements.



A joint of sufficient strength and rigidity



Driving the wooden pile to ground level



All these requirements are met by the Raymond Composite Pile

To secure a satisfactory Composite Pile the essential requirements are:—

1. To provide a means of driving a wood pile and a superimposed concrete section so that a perfect alignment may be maintained between the two sections.

2. To accomplish this driving in a manner that will preserve the head of the wood pile from injury during the driving. (Any distortion or destruction of the head would, of necessity, weaken the joint of which it forms a part or allow settlement between the concrete and wood sections.)

3. To provide a tight joint which will exclude water, mud, running sand or other foreign substances.

4. To provide reinforcement and anchorage to lock the concrete section to the wood section so that the two units cannot separate or be displaced by ground pressure upheaval.

5. To provide a joint that unites the two materials so that the transverse strength at any section will approximate that of the wood pile.

6. To carry on operations in a manner that will permit of the inspection and checking of each step.

All these requirements are met by the RAYMOND COMPOSITE PILE.

The steps involved in placing these piles consist of:—

1. *Driving the wood pile to ground level.*

2. *Fitting on to the top of the wood pile the collapsible mandrel or follower encased in a spirally reinforced steel shell.*

3. Driving the combined unit to its final penetration.

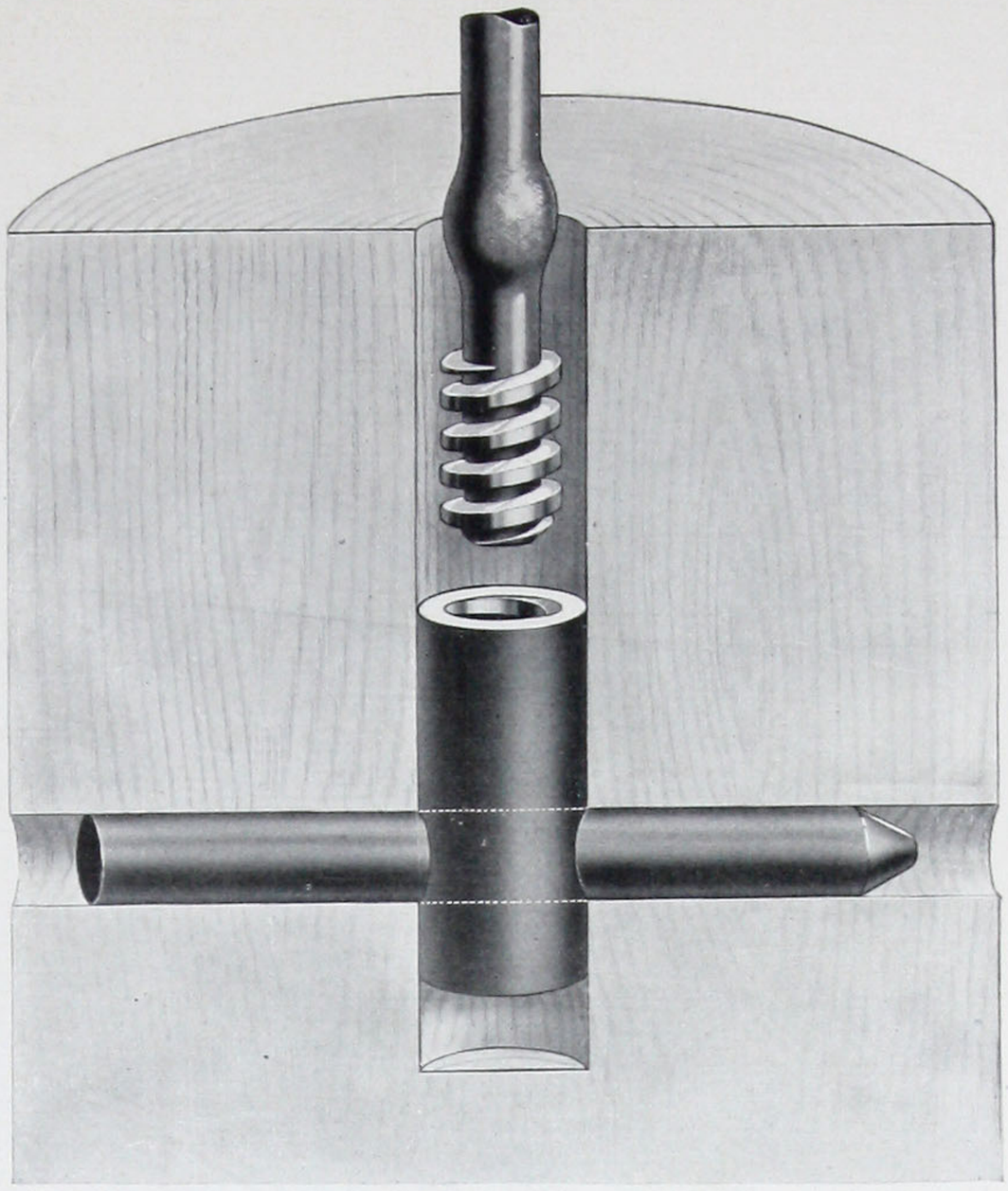
4. Withdrawing the mandrel, leaving the steel shell in the ground to protect and serve as a mold for the concrete at the joint.

5. Filling this shell with concrete

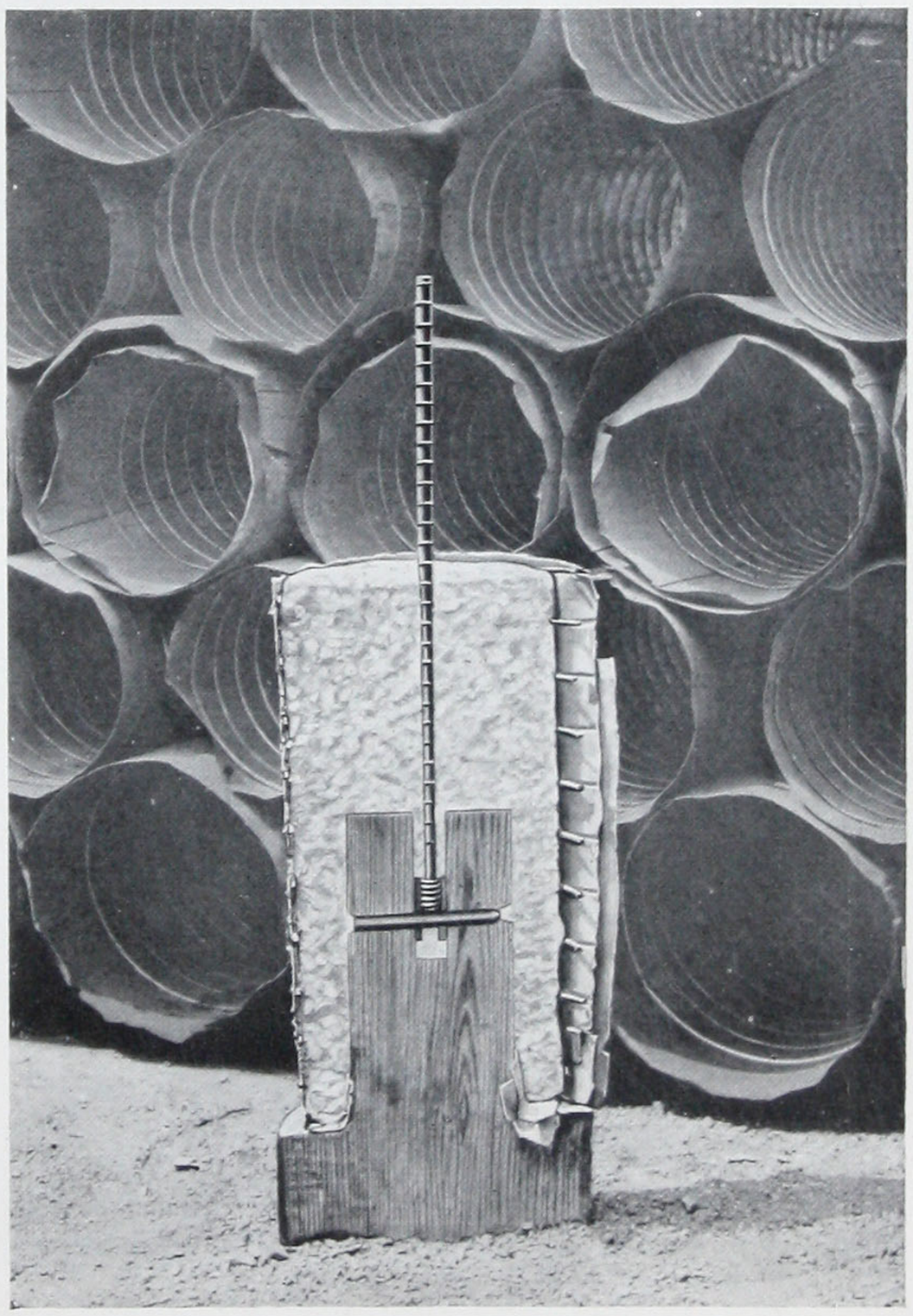
Before being driven, the wood pile is provided with a tenon approximately 9½ inches in diameter and 18 inches long. *By means of a special machine, this tenon is accurately shaped and cut square on the end* so that a perfect contact is provided between the follower and the pile, thereby avoiding any brooming or damage to the tenon during the period of driving. This tenon likewise fits closely the cylindrical opening at the end of the RAYMOND core and thereby insures a true alignment between the wood and the concrete sections.

A hollow boot closely encases the bottom of the steel shell on the core, and, at the same time, fits tightly over the tenon of the wood pile. These joints are so perfect in their fit that all water, mud or other foreign matter is excluded from the interior of the shell. *A perfect form, susceptible of inspection, is thus provided* to receive the concrete which fills the space of about two inches between the wood tenon and the outer shell of the concrete pile. The spiral reinforcing of the shell adds to the strength of this cylinder of concrete which surrounds the top part of the wood pile.

Before the wood pile is placed in the leads, *a hollow steel socket is embedded in the center of the tenon and secured by a seven-eighths inch steel pin extending transversely through the tenon and socket.*



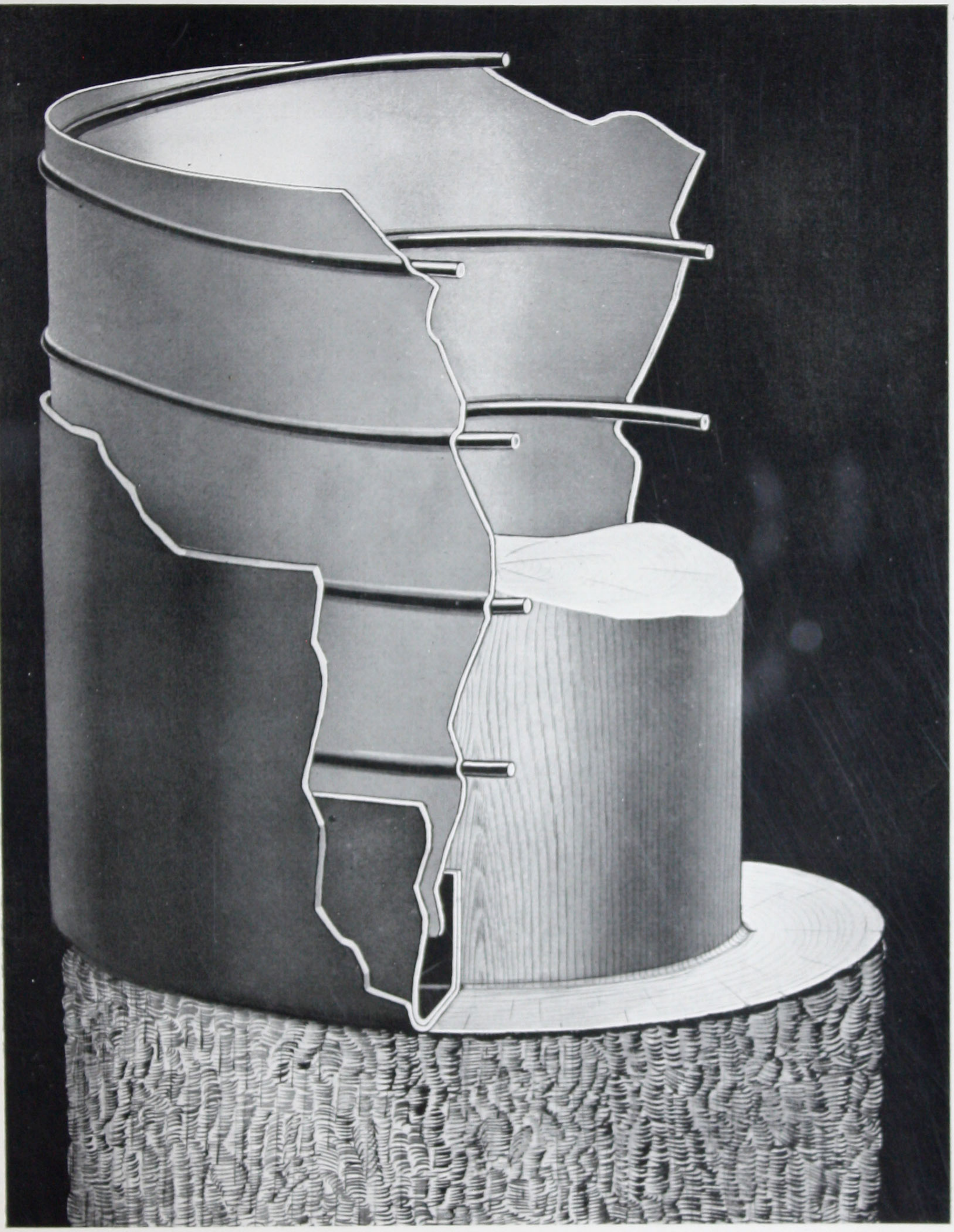
Anchor for reinforcing Rod in Composite Piles



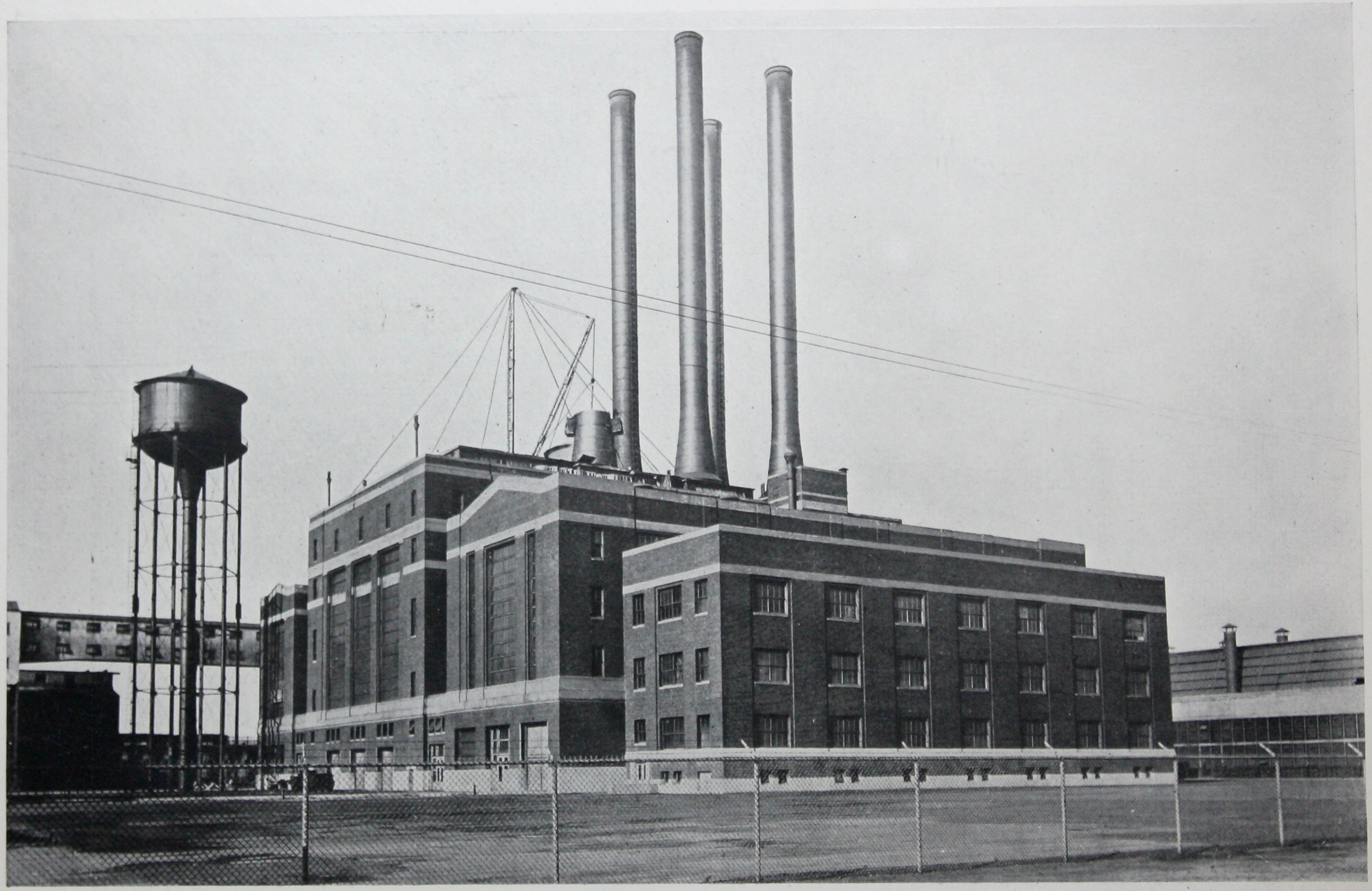
By means of a special machine, this tenon is accurately shaped and cut square on the end



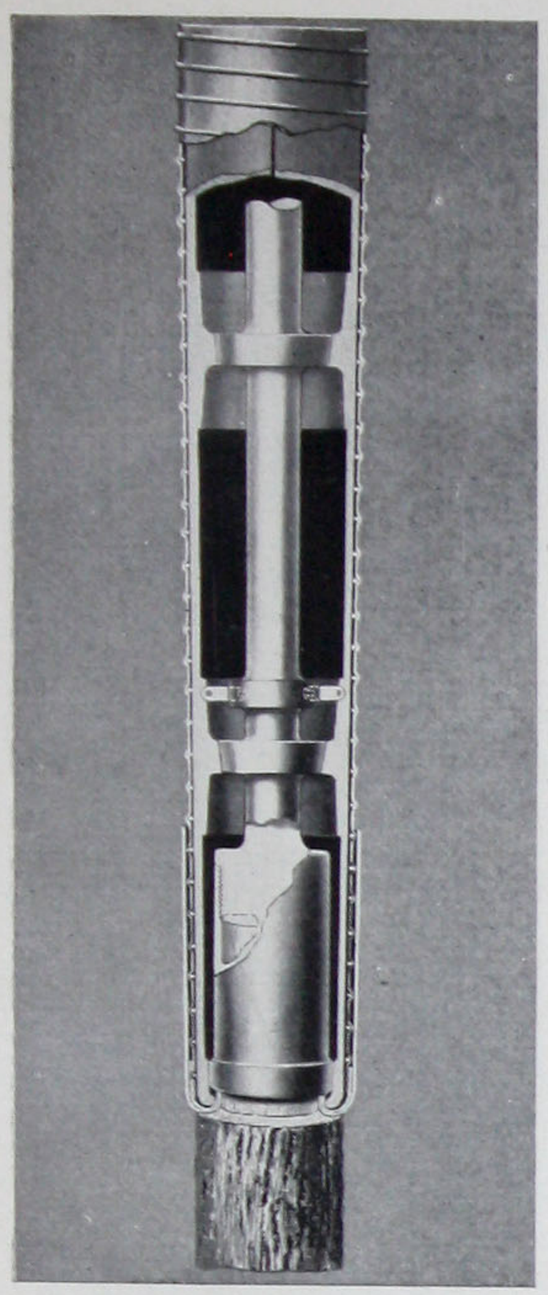
Fitting on to the top of the wood pile the collapsible mandrel or follower encased in a spirally reinforced steel shell



A hollow boot closely encases the bottom of the steel shell on the core, and, at the same time, fits tightly over the tenon of the wood pile



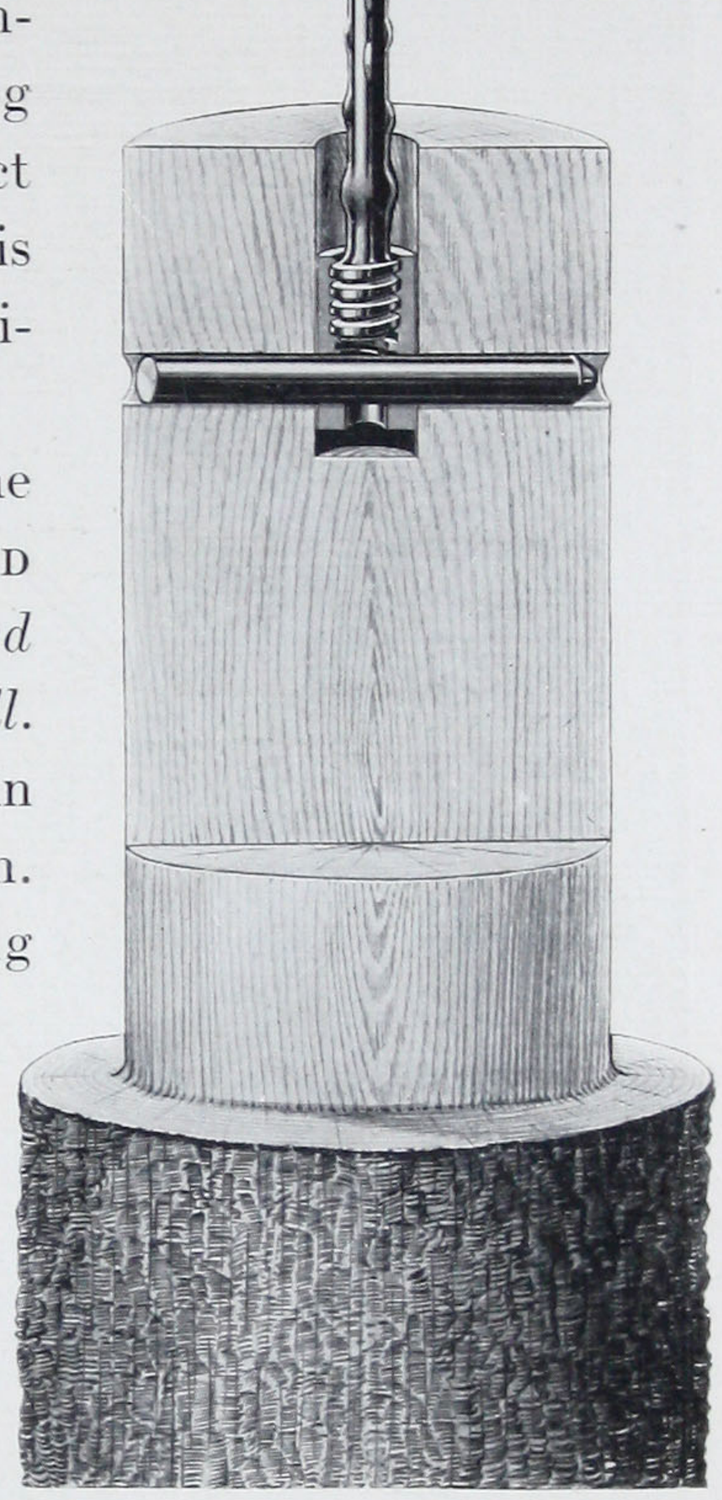
Power House at the River Rouge Plant of the Ford Motor Company, Detroit, Michigan. W. B. Mayo, Chief Engineer.
There are approximately 6800 Raymond Composite Piles in the foundations of this building



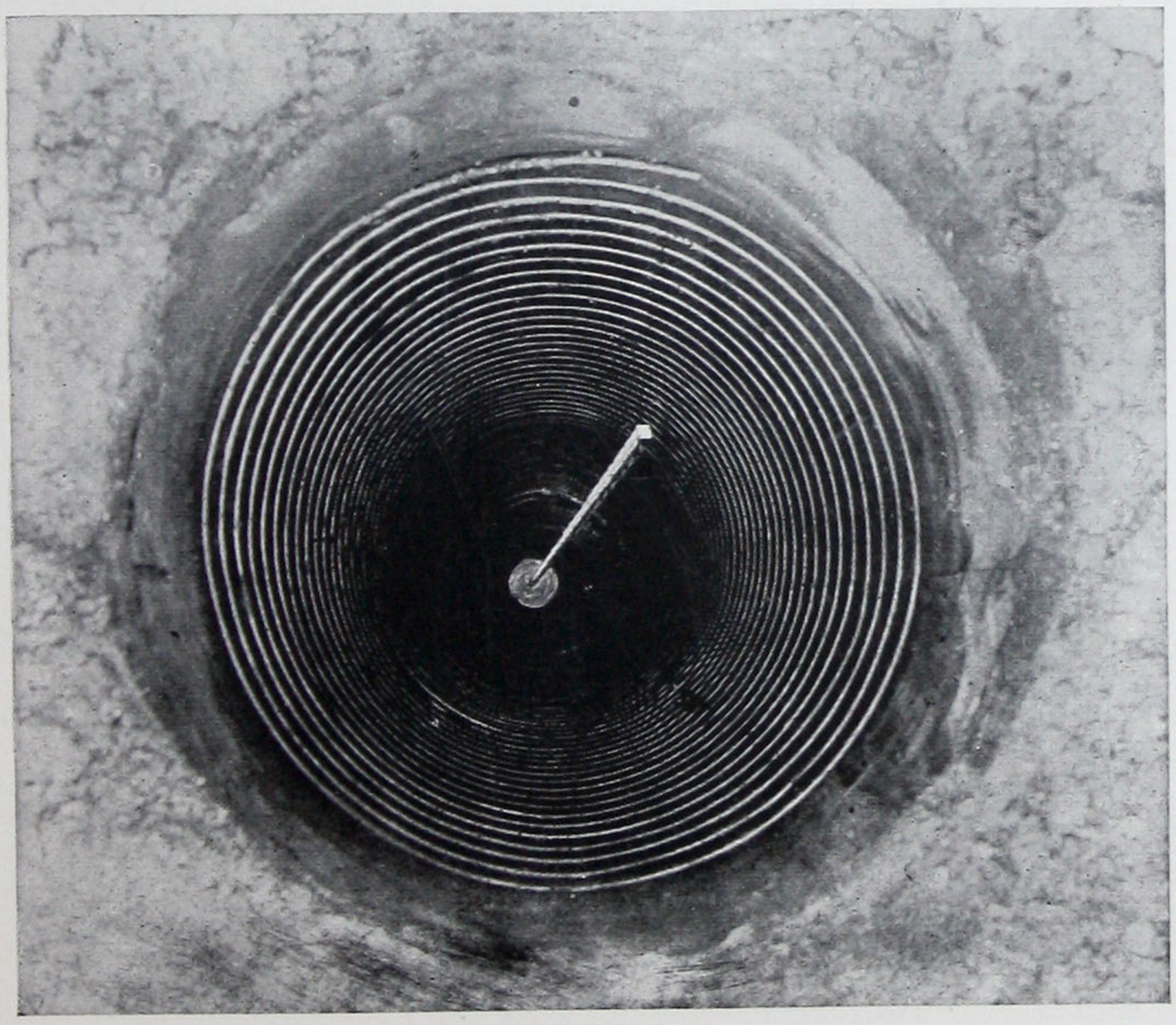
By using a Raymond Composite core which is encased in a spirally reinforced steel shell

This socket has a heavy internal thread which receives the threaded end of a deformed bar. The bar is screwed into the socket after the wood pile has been followed down to its final position and the core or follower has been collapsed and removed. It thus provides a reinforcement in the concrete and also acts as a rigid lock between the wood and the concrete. This lock is strong enough to withstand a direct pull of over ten tons which is considerably in excess of ordinary requirements.

The concrete section of the pile is made *by using a* RAYMOND *Composite core which is encased in a spirally reinforced steel shell.* This core acts as a follower in carrying the wood pile down to the desired elevation. The core is then collapsed and withdrawn, leaving the shell in the ground to be filled with the concrete. When this has been done a perfect concrete pile is securely locked to the top of the wood pile.



A hollow steel socket is embedded in the center of the tenon and secured by a seven-eighths inch steel pin extending transversely through the tenon and socket



A perfect form susceptible of inspection is thus provided



A composite pile exposed to a point below the joint



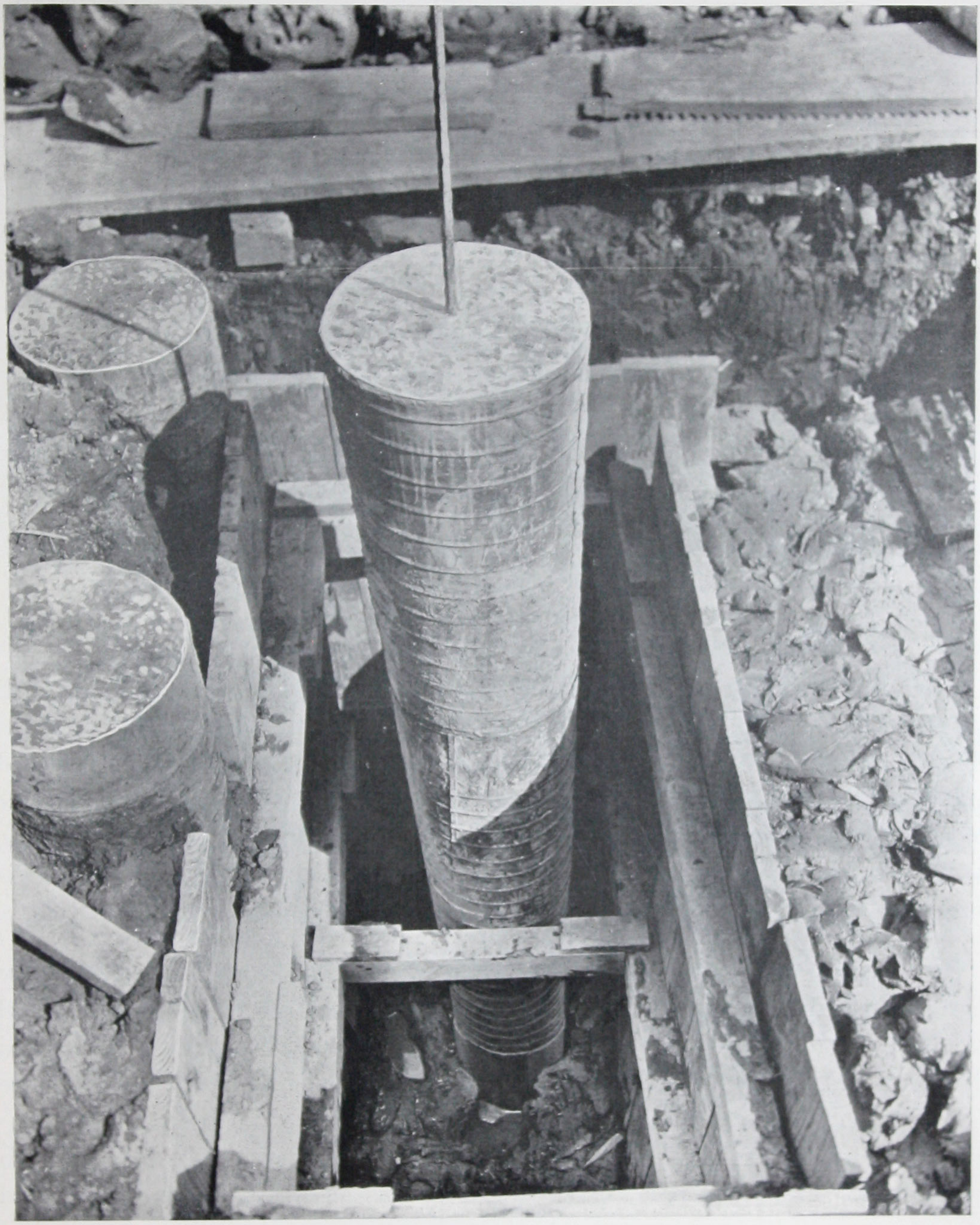
A test load of 103,000 lbs. caused a total settlement of .456 of an inch

Test for the Chicago Building Department

In April, 1922, the Building Department of the City of Chicago conducted a test on RAYMOND COMPOSITE PILES. In this instance, the length of the wood pile was 43 feet and the concrete section 12 feet, making a total of 55 feet. The wood pile was driven to ground level with 90 blows of a No. 1 Vulcan type steam hammer having a moving part weighing 5,000 lbs. and falling a distance of 3 feet at the rate of 60 blows to the minute. The RAYMOND Composite Core was then placed on top of the wood pile as a follower and 565 blows of the No. 1 hammer were required to drive the pile the additional 12 feet to hardpan. *A test load of* 103,000 *lbs. caused a total settlement of* $\frac{29}{64}$ *of an inch*, which is well within the allowable settlement for a safe load of 25 tons under the Chicago Building Department requirements of the City Code.



The pile was excarated. . . A portion of the concrete was cut away to expose the wood tenon



The pile tested was the first one driven of a group of three



A tested "joint"—indicating that this type of joint develops greater strength than the wood pile

After the load had been removed, *the pile was excavated* to a point about 18 inches below the joint, and the wood pile sawed off at this level. The concrete pile was then also cut off about 4 feet higher up, and the joint section thus obtained was raised to the surface of the ground for further examination. *A portion of the concrete was cut away to expose the wood tenon*, the top of which, notwithstanding the 655 blows of the No. 1 hammer, was in perfect condition and showed no evidence of splintering or "brooming".

As will be seen from the photograph, *the pile* tested *was one of a group of three* placed at points of a triangle on 3-foot centers. It was the first one driven and concreted. The shell of the second pile of the group was left open (i.e., not filled with concrete) while the third pile was driven, and these two empty shells were allowed to remain open for an hour or more, after which a most thorough examination failed to disclose any seepage of mud, water or other foreign element into the interior. The wood pile used in this test was an average cypress pile and was not specially selected for straightness or quality. Standard RAYMOND Equipment was used throughout.



Working Loads

In many soil conditions, RAYMOND COMPOSITE PILES can be loaded in excess of the maximum load allowed on wood piles for the reason that the large surface area and taper of the concrete section relieve the underlying wood member from much of its load. It must, however, be borne in mind that the carrying capacity of a pile is necessarily dependent on the nature of the soil which it penetrates.

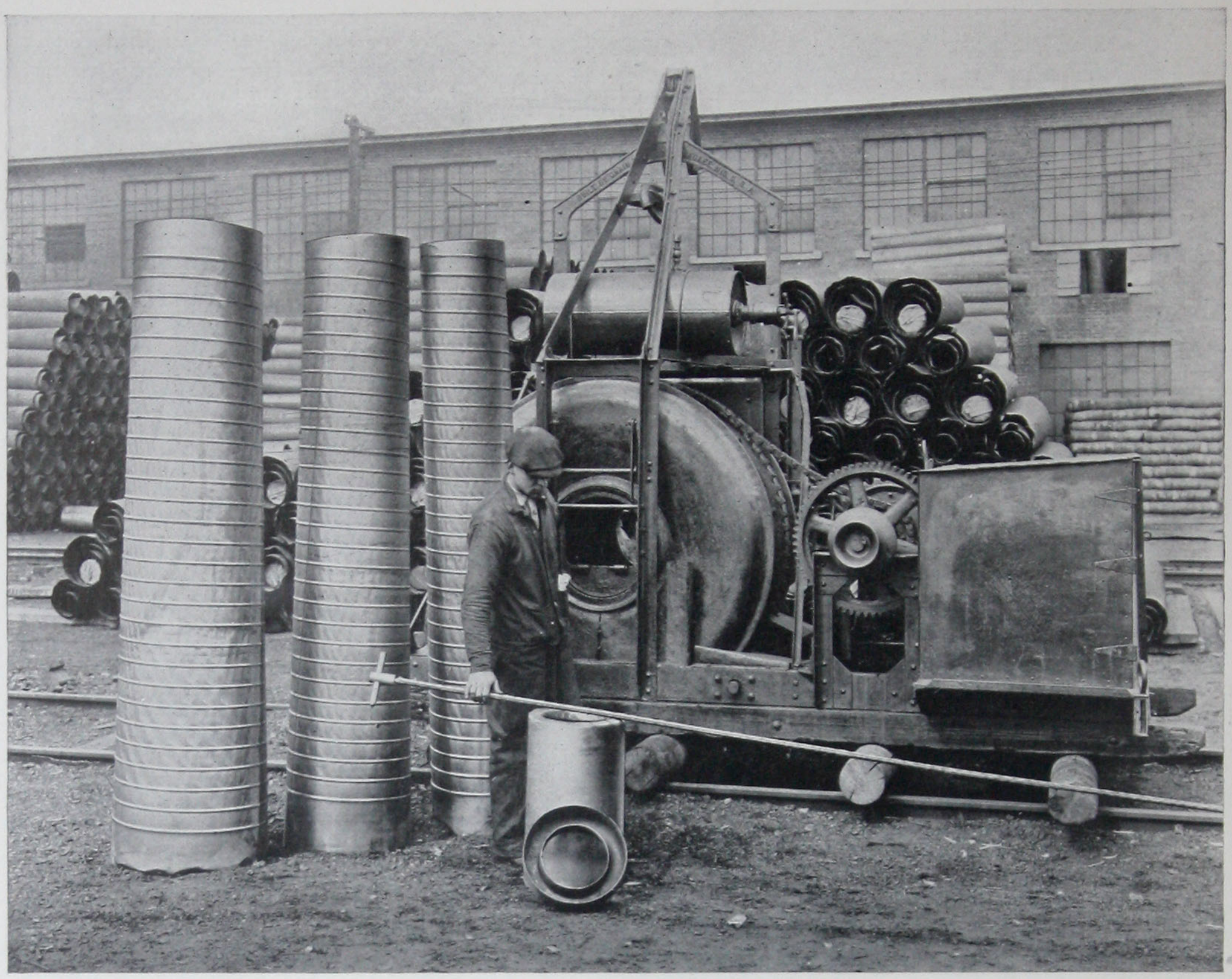
In calculating the resistance which this penetration develops, there has been devised what is known as the "Engineering News Formula". This is recognized as a fairly accurate gauge of the carrying capacity of a pile. For steam hammer driving, it is as follows:—

$$L = \frac{2\ W\ H}{S + 0.1}$$

L = Load in pounds
W = Weight of falling parts in pounds
H = Drop in feet of falling parts
S = Final penetration per blow in inches

A No. 1 steam hammer has a weight of five thousand pounds falling 36 inches.

A No. 2 steam hammer has a weight of three thousand pounds falling 30 inches.



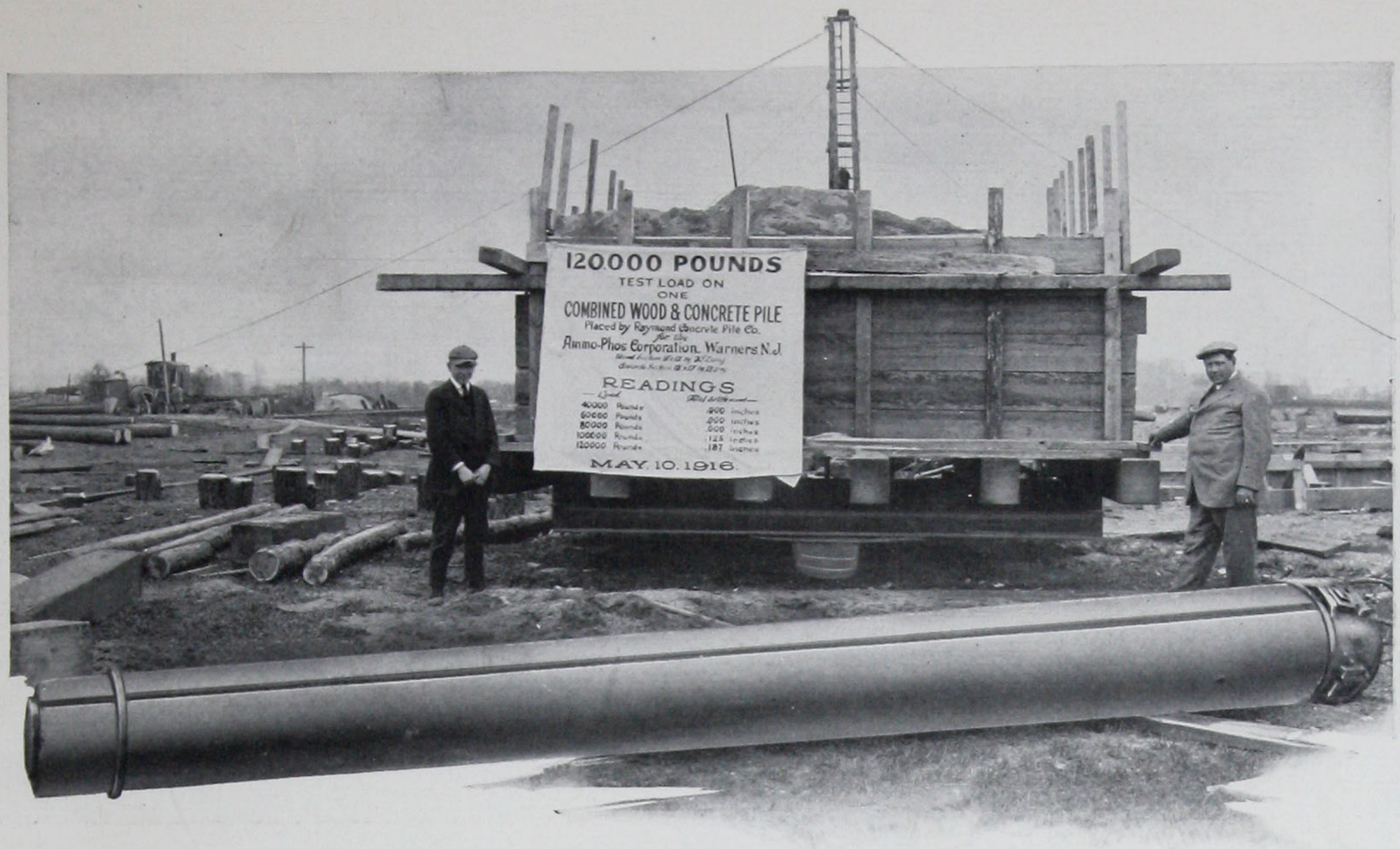
This illustration shows the boot, sleeve, ring and three sections of shell used in the making of a composite pile. Note also the socket, pin and bar-end for bonding

Pile Spacing

RAYMOND COMPOSITE PILES can ordinarily be driven 2 feet 6 inches center to center, although under some conditions it is desirable to space the piles farther apart.

The shell into which the concrete section of the pile is cast permits of rather close spacing, since it protects the green and setting concrete from distortion or earth movement caused by the driving of adjacent piles.

We recommend, however, that you confer with our nearest office as to pile layout, as it often proves economical to work out the spacing of the piles to meet particular and specific conditions.

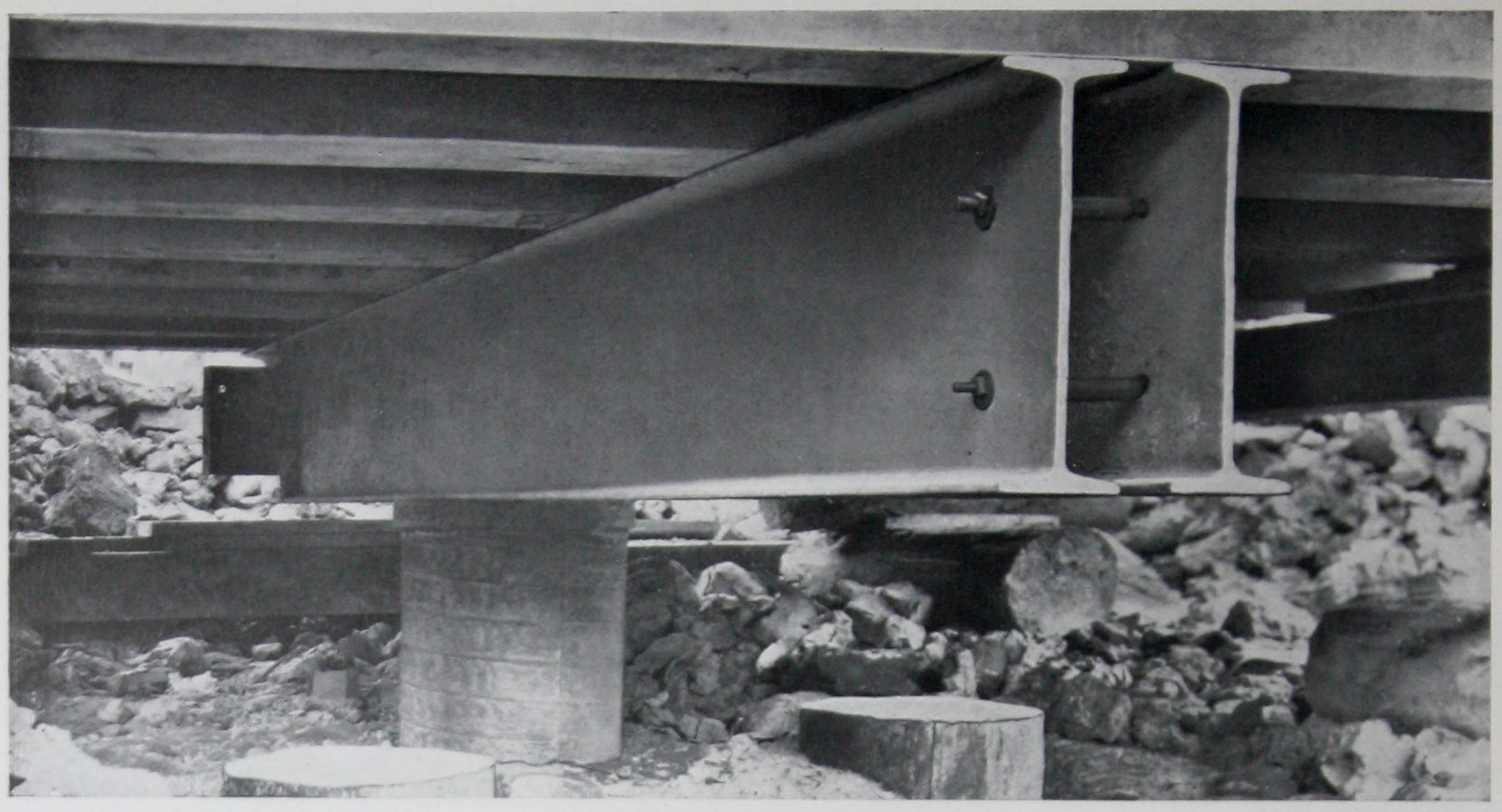


A test load of 120,000 lbs. produced a settlement of but .015 feet.

Load and Joint Tests

Extensive tests of and experiments with Raymond Composite Piles have been carried on since 1916. The Company has, in actual practice, made numerous satisfactory load tests, some up to 60 tons on single piles. The piles placed have varied in overall lengths from 35 feet to as much as 117 feet, with concrete sections varying from 8 to 22 feet long, depending on the distance from cut-off to permanent water level. Tests and experiments covering a period of more than six years were carried on, during which time the Company placed approximately 42,000 Raymond Composite Piles before wide publicity was given to this system of pile foundation work.

The accompanying photograph shows a 60-ton test made at Warners, N. J., in 1916. The ground was very soft "marsh" mud to a depth of 33 feet, below which hardpan was found. The wood pile used was 20 feet long and the concrete section 15 feet long, making a total length of 35 feet. This brought the joint of the two sections much nearer to the center of the pile than is usual in composite pile construction. Furthermore, the soil at the elevation of the joint was



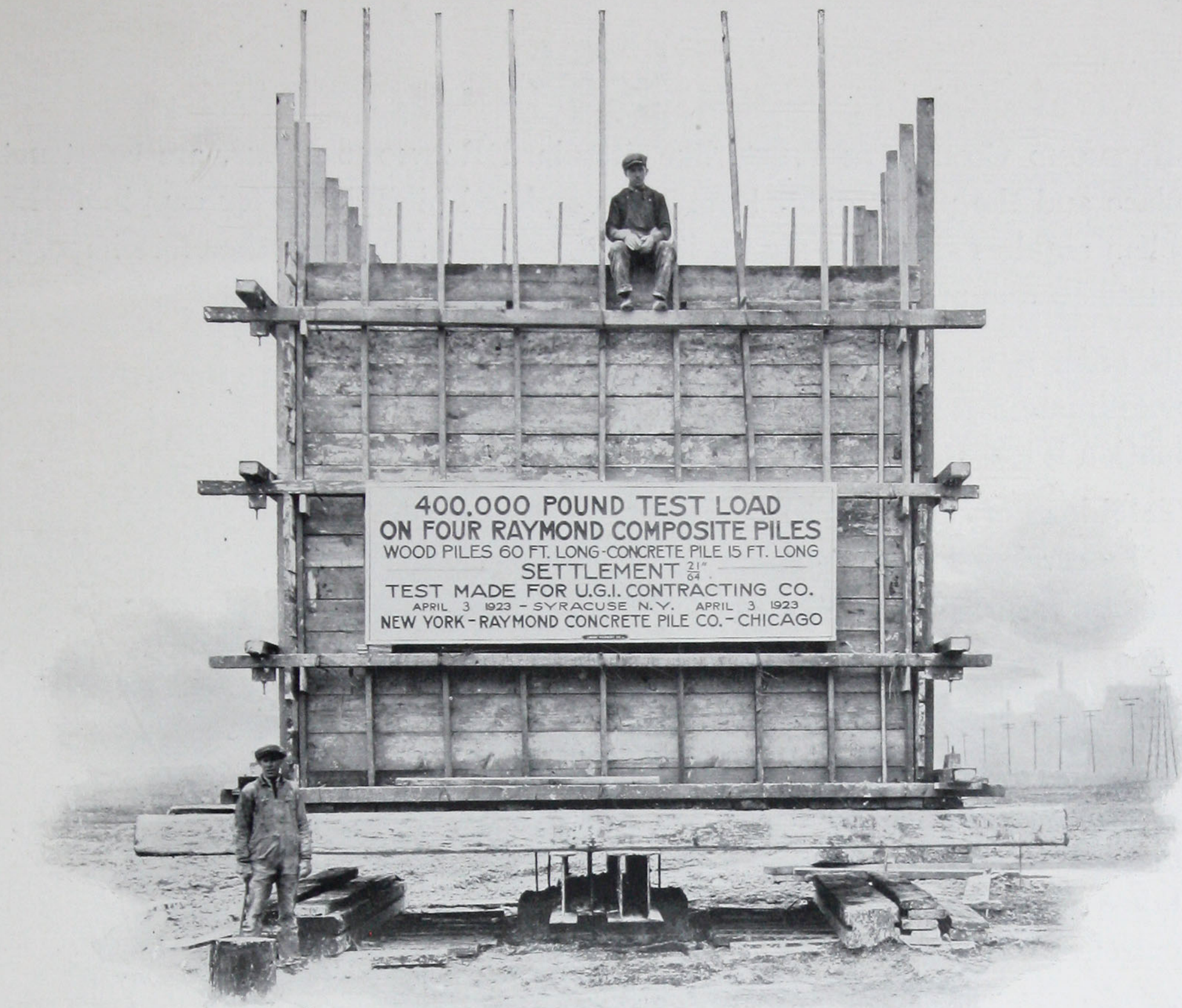
Raymond Composite Piles have been tested

of a fluid character giving minimum lateral support. Notwithstanding the severity of the conditions, *a test load of* 120,000 *pounds produced a settlement of but* $\frac{3}{16}$ *of an inch.*

Raymond Composite Pile joints have been tested as simple beams, as cantilevers and as unsupported columns. The tests have been many and varied; they have been carried out under conditions infinitely more severe than any which are likely to be encountered in actual practice; and the results have been such as to satisfy the most exacting critic.



The actual placing of Raymond Composite Piles



200 tons on four composite piles, wood section 60 feet, concrete section 15 feet. Total settlement .34 in.
U. G. I. Contracting Co., Syracuse, N. Y.



40 tons on one composite pile. Total length 56' 6". Total settlement .125 in. Fort Sumter Hotel, Charleston, S.C

Cost

RAYMOND COMPOSITE PILES, like Standard RAYMOND PILES, are constructed in place and the prices quoted are for completed piles ready for capping. Each problem requires special study for its proper solution and it is therefore impossible to quote even approximate prices for general use.

In order to make a preliminary estimate, the following information is essential:

1. Total load of superstructure to be carried; load for each column and a plan of structure.
2. Nature of the soil; approximate depth to which wood piles would penetrate below permanent water level; distance from water level to cut-off.
3. Location and accessibility (i.e., roads, railroad or water facilities) of the site; a rough sketch of the same.
4. Cost of concrete materials and wood piles delivered on the work.
5. In general the more information presented, even in preliminary negotiations, the more accurate will be the estimate of cost.



A pier of composite piles ready for the concrete footing

Our Engineering Department is available at all times for investigation work and for submitting of recommendations, designs and estimates.

A list of our branch offices will be found on the last page.

Specifications

It has frequently been the Company's experience that architects and engineers, in order to be assured of satisfactory results, wish to specify RAYMOND COMPOSITE PILES. Occasionally it is considered inadvisable to designate the type of pile by name, and, in such an event, the following specifications will cover RAYMOND COMPOSITE PILES:

Composite Piles shall be of a type specifically approved by the architect or engineer and shall be placed in the following manner:

A cast-in-place concrete pile not less than 14 inches in diameter at the point and cast in a steel shell, which shall remain in the ground, shall be superimposed upon a sound wood pile of suitable size and length.

The head of the wood pile shall be so shaped and sized that it may be imbedded 18 inches longitudinally in the concrete section and surrounded by at least 2 inches of concrete.

The head of the wood pile shall be anchored to the concrete section by a deformed bar extending throughout the concrete section and firmly connected to the wooden section in such a manner as to withstand a pull of at least 10 tons.

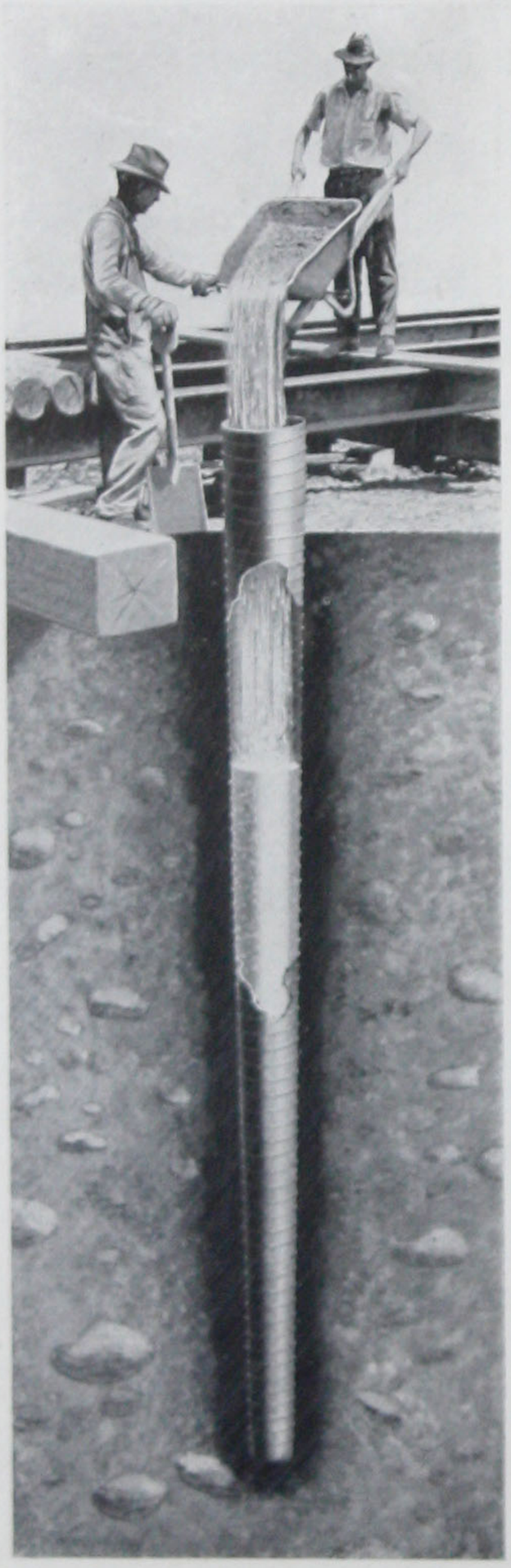
The joint between the steel shell and wood sections shall be thoroughly sealed so that after the withdrawal of the driving core the joint may be readily inspected before the concrete is poured.

The metal form into which the concrete is poured shall be of sufficient strength to prevent distortion or bulging while the cavity is being filled with concrete or while the adjacent piles are being driven.

The Standard Raymond Concrete Pile

It is not the purpose of this catalogue to deal with the Standard Raymond Concrete Pile; the Company has a special catalogue devoted to that type of pile and to the Company's work in the design and construction of reinforced concrete docks, bulkheads, sea-walls, retaining-walls, shipways, bridges, tunnels, heavy foundations, etc.

The Standard Raymond Concrete Pile is widely known throughout the architectural and engineering professions. More than 80% of the concrete piling used in the United States is placed by the Raymond Company.



Filling this shell with concrete

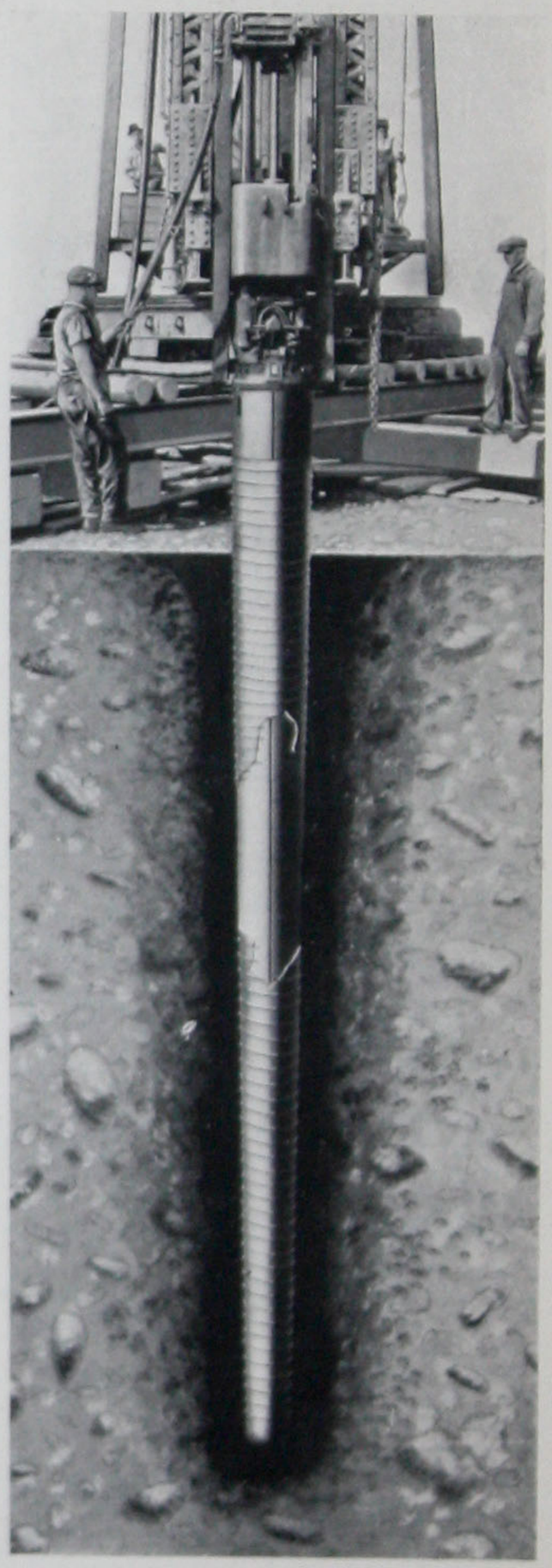
The steps involved in placing a Standard Raymond Pile are:—

1. *Driving a collapsible mandrel or core encased in a spirally reinforced steel shell.*

2. Withdrawing the mandrel after sufficient penetration has been secured, leaving the shell in the ground to protect and serve as a form for the concrete.

3. *Filling this shell with concrete.*

The Raymond Pile is the *only* Concrete Pile having a permanent form (or shell) which remains in the ground.



Driving a collapsible mandrel or core encased in a spirally reinforced steel shell

RAYMOND CONCRETE PILE COMPANY

Offices

New York City	Chicago
140 Cedar Street	111 West Monroe Street

Atlanta	Healy Building
Baltimore	Munsey Building
Boston	Park Square Building
Cleveland	Union Building
Detroit	Empire Building
Kansas City	Huntzinger Building
Norfolk	Royster Building
Philadelphia	1423 Locust Street
Pittsburgh	Union Bank Building
St. Louis	Railway Exchange Building
Los Angeles	Washington Building
San Francisco	615 Monadnock Building
Portland, Oregon	194 North 13th Street
Houston	425 West Building

Canada

Raymond Concrete Pile Co., Ltd.,
New Birks Building, Montreal

Great Britain

J. & W. Stewart
12, Berkeley St., London, W. I.

PRINTED IN U. S. A.

[BLANK PAGE]

API INTERNATIONAL

CCA

[BLANK PAGE]

API INTERNATIONAL

CCA